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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/866,319	05/25/2001	Jeffrey B. Johnson	BUR920010011US1	5556

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EXAMINER

FARAHANI, DANA

ART UNIT	PAPER NUMBER
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2814

DATE MAILED: 08/20/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/866,319

Applicant(s)

JOHNSON ET AL.

Examiner

Dana Farahani

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 May 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 2-45 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 2-45 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____. 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in-

(1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or

(2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

2. Claims 4, 6, 8, 12, 13, 15, 16, 19, 23-25, 45, 28, 30, 32, 34-36, 39-41, and 43 are rejected under 35 U.S.C. 102(e) as being anticipated by Marty et al., hereinafter Marty (U.S. Patent 6,316,818), previously cited.

In regard to claims 4, 45, 24, 28, and 34, Marty discloses in figure 6 a method of fabricating of a bipolar device comprising the steps of providing a structure comprising at least a sub-collector region 2, a collector region 4 and isolation regions 5, the collector region has a deep collector region located therein; forming an n-type dopant region, SiC, within the collector region, in contact with the deep collector region, and the SiC region has a vertical width sufficiently narrow (the SiC region does not contact collector-base junction) to avoid lowering collector-base breakdown and a dopant high enough (it is more heavily doped than the collector. See column 4, lines 4 and 5) to restrict base widening when a base-emitter junction is forward biased; and forming a base, Be, and an emitter 11 of figure 5.

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In regard to claims 6 and 30, the n-type region dopant is Phosphorus (see column 3, lines 65-67; and column 4, lines 1-5).

In regard to claim 8, the n-type (SiC) region of Marty is formed by ion implantation (and annealing). See column 3, the last two lines; and column 4, lines 1-5.

In regard to claims 12 and 25, the n-type dopant region, SiC, is located adjacent the base collector junction (Be region and 4 of figure 6).

In regard to claims 13 and 32, a lightly doped region of collector 4 (the region above SiC), separates SiC from the base (see figure 6).

In regard to claims 15 and 39 Marty discloses the base is a hetero-junction (see column 3, lines 30-39; and column 5, line 31).

In regard to claims 16, 40, and 41, Marty further discloses that the hetero-junction base is SiGe, and has monocrystalline and polycrystalline layers (see column 3, lines 40-45).

In regard to claim 19, Marty discloses portions of the single crystal region of the base are doped to form an extrinsic base regions (see column 4, the last three lines).

In regard to claim 23, the sub-collector is formed by ion implantation (see column 2, line 47).

In regard to claims 35 and 36, substrate 1 is silicon (see column 2, line 44).

In regard to claim 43, single crystal region 82 contains extrinsic and intrinsic base (see column 4, the last three lines).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 2, 3, 14, 22, 26, 27, and 33, are rejected under 35 U.S.C. 103(a) as being unpatentable over Marty.

In regard to claims 2 and 3, Marty discloses the limitations in claims 45, 2, and 3, as discussed above, except for expressly disclosing the vertical width of the SiC region.

Marty, however, discloses that the SiC region reduces the resistance of the collector region. It would have been obvious to one of ordinary skill in the art at the time of the invention to adjust the height of the SiC region in order to adjust the resistance of the collector region. A change in size is generally recognized as being within the level of ordinary skill in the art. *In re Rose*, 105 USPQ 237 (CCPA 1955).

In regard to claims 14, 26, 27, and 33, Marty discloses the limitations in claims 45, 13, and 14, as discussed above, except for expressly disclosing the width lengths in the claims. It would have been obvious to one of ordinary skill in the art at the time of the invention to include the range of the region between the n-type region and the base, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

In regard to claim 22, Marty discloses the limitations in claim 45, as discussed above, except for ion implantation being used to form the deep collector. However, Marty teaches that the sub collector layer is formed by ion implantation (see column 2, line 47). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use ion implantation to form the collector region, also, since the method would have been readily available due to its use for the sub collector region, and furthermore, implantation is a widely known and used method for making doped semiconductor regions.

5. Claims 5 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Marty as applied to claim 45 above, and further in view of Wen et al., hereinafter Wen (U.S. Patent 5,252,841), previously cited.

Marty discloses the limitations in claims 45 and 5, as discussed above, except for expressly disclosing the base layer is more heavily doped than the SiC region. Wen discloses at column 6, lines 40-43 that higher base doping results in more base conductivity. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to make the base layer more heavily doped than the SiC region in the collector in order to change the resistivity of those layers.

6. Claims 7 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Marty as applied to claim 6 above, and further in view of Ohmi et al., hereinafter Ohmi (U.S. Patent 5,541,444), previously cited.

Marty discloses the limitations in claims 6 and 7, as discussed above, except for Sb is used as a dopant of the base region.

Ohmi discloses at column 9, lines 25-34, that Sb has small diffusion constant, and therefore, is used in bipolar transistors, since small diffusion constant minimize spreading of the impurity during heat-treatment period. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use Sb in Marty's structure, in the base, because of small heat diffusion of the material and in order to minimize spreading of impurity during heat treatment.

7. Claims 9, 10, 37, and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Marty as applied to claim 8 above, and further in view of Rodgers (U.S. Patent 3,924,265), previously cited.

Marty discloses the limitations in claims 8-10, as discussed above, except for the specific dopings of the n-type region and the amount of energy for ion implantation.

Rodgers teaches ion implantation energy of 50 KeV to implant boron ions as part of completing a transistor structure. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use this amount of energy, as Rodgers teaches, in order to implant the n-region of Marty's structure.

Although Marty does not disclose the specific doping of the n-region, it is within the level of ordinary skill in the art to choose the desirable doping concentration of the n-region, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

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8. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Marty as applied to claim 8 above, and further in view of Akatsu et al., hereinafter Akatsu (U.S. Patent 6,329,704), previously cited.

Marty discloses the limitations in claims 8-11, as discussed above, except for the annealing being performed at a temperature of about 900 C, or higher, for about 15 seconds or less.

Akatsu discloses annealing is performed with implantation at 900 C to 1050 C from 5-15 seconds to produce the desired resistance at the layer being annealed (see column 5, lines 20-34). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use this temperature and time limit to perform the annealing of Marty's structure in order to make the n-type heavily doped region of Marty's structure with a specific resistivity.

9. Claims 17 and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Marty, as applied to claim 16 above, and further in view of Sato (U.S. Patent 6,020,245), previously cited.

Marty discloses a patterned insulator 9 with an opening to expose a portion of the base region.

Marty does not disclose that the emitter is polysilicon.

Sato discloses that polysilicon emitters are advantageous, because they increase the current amplification factor of the transistor. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use a polysilicon emitter in Marty's structure, so the transistor would have a higher current amplification factor.

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10. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Marty in view of Sato, as applied to claim 17 above, and further in view of Ju (U.S. Patent 6,476,446), previously cited.

Marty discloses the patterned insulators on top the SiGe containing layer are etched (see column 3, lines 54-65).

Marty does not disclose lithography is used also in those layers.

Ju discloses removing of an insulator is etched with conventional lithography techniques. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use lithography with etching to make opening of the insulator layers of Marty's structure, since lithography is commonly used with etching, when one wants to remove insulating, or non-insulating layers of a semiconductor structure.

11. Claims 20 and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mary as applied to claim 16 above, and further in view of Botula et al., hereinafter Botula (U.S. Patent 6,429,489), previously cited.

Marty discloses the limitations in claims 16 and 20, as discussed above, except for SiGeC being used instead of SiGe in the base layer.

Botula discloses SiGeC is used in a base of a HBT, wherein the presence of carbon along with Germanium makes the transistor a high frequency threshold transistor. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use SiGeC in the base of Marty's structure in order to make the transistor a high frequency threshold transistor.

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12. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Marty as applied to claim 16 above, and further in view of Trivedi et al., hereinafter Trivedi (U.S. Patent 6,410,984), previously cited.

Marty discloses the limitations in claims 16 and 21, as discussed above, except for CVD being used to deposit the SiGe layer.

Trivedi teaches CVD method is used as a method of forming a layer of an interconnect structure. It would have been obvious to one of ordinary skill in the art at the time of the invention to use CVD method to form the SiGe layer, since the CVD method completely covers the layer beneath the deposited layer, and the method is widely used.

Response to Arguments

13. Applicants' arguments filed on 5/30/03 have been fully considered but they are not persuasive.

Applicants argue that Marty does not disclose the claimed method. Specifically, applicants assert, Marty does not disclose forming the n-type doped region first and then forming the base of the device, as claim 45 requires. The Office notes that claim 45 does not require such an ordered process, since it does not state the four process steps (a, b, c, and d) are carried out in a specific order. Rather, what stated are merely the four process steps.

Applicants further allege that "the resultant implant (SIC)... is a broad shallow profile" which requires a high-energy and a light ion, such as phosphorus, referring to

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the region in the primary reference. Applicants conclude that this does not meet the limitation in the claims, namely, an n-type dopant region having a vertical width sufficiently narrow to avoid lowering collector-base breakdown voltage. However, note that the reference discloses at column 3, lines 65-67; and column 4, lines 1-5, that although phosphorus is used as an implant, the doping can be carried out selectively. Use of phosphorus does not cause the implantation to be done so sporadically that the implant region contacts the base, as applicants allege (also, see figures 2 and 3, wherein it is shown that the n-region is a distinct region, contact free to either base or collector). Furthermore, note that there is a deep collector region in Marty (the lower portion of the collector region), and the n-type region is in contact with the deep collector region.

Finally, the n-type region is sufficiently highly doped to restrict base widening, as discussed in the above rejection.

Regarding the applicants' arguments for the remaining references, they are merely recitations of the alleged deficiencies of the Marty reference, and therefore, the above response applies to those arguments as well and will not be repeated here.

It is now believed that all applicants' arguments are considered and responded to accordingly.

Conclusion

14. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dana Farahani whose telephone number is (703)305-1914. The examiner can normally be reached on M-F 8:00AM - 5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (703)308-4918


.. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0956.

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Dana Farahani
August 16, 2003



LONG PHAM
PRIMARY EXAMINER